

British Engineering Standards Association.

(Incorporated 1918.)

FORMED IN 1901 AS THE ENGINEERING STANDARDS COMMITTEE

BY

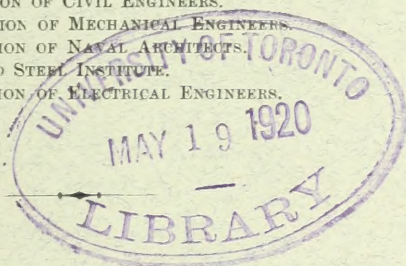
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THE IRON AND STEEL INSTITUTE.

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BRITISH STANDARD SPECIFICATION FOR INSTRUMENT TRANSFORMERS.

LONDON:

PUBLISHED FOR THE ASSOCIATION BY CROSBY LOCKWOOD & SON,
7, STATIONERS' HALL COURT, LUDGATE HILL, E.C. 4; AND 5, BROADWAY, LONDON, S.W. 1:
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Note.—The Association desires to call attention to the fact that this Specification is intended to include the technical provisions necessary for the supply of the article herein referred to, but does not purport to comprise all the necessary provisions of a Contract.

BRITISH STANDARD SPECIFICATION FOR INSTRUMENT TRANSFORMERS.

5

DEFINITIONS.

Instrument Transformer.

10

1. An Instrument Transformer is a transformer designed for use with indicating, integrating and graphically recording instruments, relays and other similar apparatus or any of them.

Current Transformer.

2. A Current Transformer is an instrument transformer designed for series connection of its primary winding in the circuit the current in which is to be measured or controlled. The ratio of transformation is a ratio of currents. 15

Ammeter Transformer.

3. An Ammeter Transformer is a current transformer designed for use in connection with a device in which the phase angle between the primary and secondary currents is unimportant. 20

Potential Transformer.

4. A Potential Transformer is an instrument transformer designed for connection of its primary winding across the circuit the pressure of which is to be measured or controlled. The ratio of transformation is a ratio of potential differences. 25

Rated Output of an Instrument Transformer.

5. The Rated Output is the output in volt-amperes marked on the name plate. 30

Rated Primary Current of an Instrument Transformer.

6. The Rated Primary Current is the value of the primary current marked on the name plate.

Rated Secondary Current of an Instrument Transformer.

7. The Rated Secondary Current is the value of the secondary current marked on the name plate. 35

Rated Primary Pressure of an Instrument Transformer.

8. The Rated Primary Pressure is the value of the primary pressure marked on the name plate.

Rated Secondary Pressure of an Instrument Transformer.

9. The Rated Secondary Pressure is the value of the secondary pressure marked on the name plate. 5

Secondary Winding of an Instrument Transformer.

10. The Secondary Winding is that which is connected to the measuring or controlling device.

GENERAL CLAUSES.

10

Standard Frequency.

11. The Standard Frequency shall be 50 periods per second.

Standard Transformers for non-Standard Frequencies.

12. Instrument Transformers for use on systems employing frequencies other than the Standard, but which comply in all other respects with the requirements of this Specification at the frequency for which they are intended, shall be British Standard Instrument Transformers; the frequency for which they are intended and the rated output at that frequency shall be marked on the name plate. 15

Terminal Markings.

20

13. The terminals shall be distinguished by the following letters or signs indelibly marked on them. On a single phase transformer the letter **T** shall be used, and on a polyphase transformer the letters **A, B & C** for the respective phases and **N** for the neutral.

The same letters shall in all cases be used on the same phase in the primary and secondary, capital letters being employed to distinguish the primary, and capital letters with circles round them being used to distinguish the secondary. 25

Marking of Polarity.

14. The relative polarity of the two ends of every winding shall be shown by the addition of markings **o** and **1** after the phase letters. The terminal marked **1** shall be referred to as the positive end of the winding. The polarity of the corresponding primary and secondary windings shall be so marked that the direction of the electromotive force at any moment from **T_o** towards **T₁** is the same as from **(T_o)** towards **(T₁)**. The same rule shall apply to the various phases **A, B & C** of a polyphase transformer. 30 35

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High Pressure Tests.

15. The high pressure test shall be applied between the winding and the frame, with the core connected to the frame and to the winding not under test, and shall be applied only on a new and completed transformer, with all its parts in place, under conditions equivalent to normal working conditions, and, unless otherwise specified, the test shall be carried out at the maker's works, at the conclusion of the temperature test of the transformer. The test pressure shall be alternating, preferably of sine wave form, and of any frequency between 25 and 100 periods per second.

The test shall be commenced at a pressure of about one-third the test pressure, and shall be increased to the full test pressure as rapidly as is consistent, with its value being indicated by the measuring instrument. The full test pressure shall then be maintained for one minute at one of the following values :—

- (i) For a current transformer for use on a three-phase system in which the neutral is earthed, either directly or through a resistance, the test pressure of the primary winding shall be 2,000 volts plus 2.25 times the rated line pressure of the system on which it is to be used, unless such line pressure be 660 volts or less, in which case the test pressure shall be 2,000 volts.
- (ii) For a current transformer for use on a single, two, or three phase system operating unearthed (insulated system), the test pressure of the primary winding shall be the same as in (i.).
- (iii) For a current transformer for use on a single, two, or three phase system, operating with one line permanently earthed, the test pressure of the primary winding shall be 50% higher than in case (i), namely, 3,000 volts plus 3.375 times the rated line pressure of the system on which it is to be used, unless such line pressure be 660 volts or less, in which case the test pressure shall be 2,000 volts.
- (iv) For the primary winding of a potential transformer, the test pressure shall be 2,000 volts plus 2.25 times the rated pressure of the circuit in which it is to be used, unless such line pressure be 660 volts or less, in which case the test pressure shall be 2,000 volts.
- (v) For the secondary windings of a current or potential transformer the test pressure shall be 2,000 volts.

Independent Tests.

16. In the event of any difference between the purchaser (or his representative) and the manufacturer as to the compliance of the transformer with this Specification, either party shall have the

(6)

right to have the transformer tested by an independent authority to be mutually agreed upon by the parties, or failing agreement by the National Physical Laboratory.

Should the purchaser or manufacturer require that any or all transformers under a contract be tested by an independent authority before acceptance, such requirement should form part of the contract.

5

CURRENT TRANSFORMERS.

Secondary Current.

17. A current transformer shall be wound to give 5 amperes secondary current with rated primary current. 10

Ratios of Transformation.

18. The following shall be the standard ratios of transformation :—

Ratio.	Ratio.
Amperes.	Amperes.
5 to 5	300 to 5
10 to 5	400 to 5
15 to 5	500 to 5
20 to 5	600 to 5
30 to 5	800 to 5
40 to 5	1,000 to 5
50 to 5	1,500 to 5
60 to 5	2,000 to 5
80 to 5	3,000 to 5
100 to 5	4,000 to 5
150 to 5	5,000 to 5
200 to 5	

15

20

25

Rated Output.

19. A current transformer shall be capable of supplying its rated output when a current of five amperes is flowing in the secondary winding and the rated primary current is flowing in the primary winding. 30

Standard Volt-ampere Ratings.

20. The two following sizes of a current transformer shall be standard at the standard frequency (*see* Clause 11) :—

35

Rated Output . . . 15 volt-amperes.
 " " . . . 40 volt-amperes.

In the case of a transformer for use on frequencies other than 50, the output at which the transformer satisfies the requirements of the specification shall be marked on the name plate (*see* Clause 12).

40

(7)

Excess Current and Temperature Rise.

21. A current transformer so connected that it would give its rated output at its rated primary current shall be capable of withstanding an overload of 25 per cent. in excess of the rated primary current for two hours without the temperature rise exceeding the limits provided in the British Standardisation Rules for Electrical Machinery (*see* B.S. Specification No. 72—1917, Section VII). 5

Note.—This condition is included in order to ensure an adequate factor of safety and also to provide for an excess reading on indicating instruments. (*See* B.S. Specification No. 89—1919, Clause 23). 10

Limits of Error.

22. The ratio error in a current transformer and the phase displacement between the currents in the primary and secondary circuits, when tested on a secondary load having a unity power factor, shall not exceed the values given in the following table :— 15

1		2	3	4	5	
		15 volt-ampere Transformer at a secondary current of 5 amperes on loads not exceeding		40 volt-ampere Transformer at a secondary current of 5 amperes on loads not exceeding		20
		5 v-a.	15 v-a.	15 v-a.	40 v-a.	
For any current from rated primary current down to and including one-fifth of rated primary current	Ratio Error + or -	1 per cent.	1 per cent.	1 per cent.	1 per cent.	25
	Phase Error *	1¼ deg.	2 deg.	1¼ deg.	2 deg.	
For any current below one-fifth down to one-tenth of rated primary current	Ratio Error + or -	1 per cent.	2 per cent.	1 per cent.	2 per cent.	30
	Phase Error *	1¼ deg.	2½ deg.	1¼ deg.	2½ deg.	

The degree of loading given in columns 2 and 4 shall not be exceeded when the higher accuracies specified in those columns are required. When the higher accuracy is not required the loadings specified in columns 3 and 5 are permissible. 35

Transformer for Circuit in which Phase Error is unimportant.

23. Ammeter transformers (*see* Clause 3) shall not be required to comply with the limits of error of phase angle given in Clause 22. 40

* See Appendix III.

Name-Plate Markings.

24. Every current transformer shall have the following particulars indelibly marked on a label permanently secured to the transformer or case :—

- (a) Country of origin. 5
- (b) The name of manufacturer or other means by which he may be identified.
- (c) The manufacturer's serial number.
- (d) The ratio of transformation of the rated primary current to the corresponding rated secondary current 10 expressed thus : 1,000/5.
- (e) The frequency.
- (f) The rated output in volt-amperes.
- (g) The term "Ammeter transformer" if Clause 23 is to apply. 15
- (h) The maximum permissible R.M.S. working pressure between primary circuit and earth.

POTENTIAL TRANSFORMERS.**Secondary Pressure.**

25. A potential transformer shall be wound to give 110 volts 20 secondary pressure when the rated primary pressure is applied, and shall be suitable for use on circuits differing from the rated pressure by not more than 10 per cent.

Ratios of Transformation.

26. The following shall be the standard ratios of transforma- 25
tion :—

Ratio.	Ratio.
Volts.	Volts.
110 to 110	3,300 to 110
440 to 110	5,500 to 110
550 to 110	6,600 to 110
660 to 110	11,000 to 110
1,100 to 110	22,000 to 110
2,200 to 110	33,000 to 110

30

Rated Output.

27. A potential transformer shall be capable of supplying its 35
rated load at a pressure of 110 volts when the rated pressure is applied to its primary terminals.

(9)

Standard Volt-ampere Ratings.

28. The three following sizes of potential transformer shall be standard :—

Rated Output 15 volt-amperes per phase.

"	"	50	"	"	5
"	"	200	"	"	

Temperature Rise.

29. The temperature rise under conditions of rated pressure and rated output shall not exceed the limits provided in the British Standardisation Rules for Electrical Machinery (B.S. Specification No. 72—1917). 10

Limits of Ratio Error.

30. The ratio error at 110 volts and at approximately unity power factor in the secondary circuit shall be not greater than one per cent. at any output not exceeding the rated output. 15

Limits of Phase Error.

31. The phase error at 110 volts and at approximately unity power factor in the secondary circuit shall not exceed half a degree at any output not exceeding the rated output.

Name-Plate Markings.

20

32. Every potential transformer shall have the following particulars indelibly marked on a label permanently secured to the transformer or case :—

- (a) Country of origin.
- (b) The name of manufacturer or other means by which he may be identified. 25
- (c) The manufacturer's serial number.
- (d) The ratio of transformation of the rated primary pressure to the corresponding rated secondary pressure expressed thus : 6600/110. 30
- (e) The number of phases.
- (f) The rated output in volt-amperes per phase.
- (g) The frequency.

APPENDIX I.

Use of Transformers in General.

Instrument Transformers complying with the requirements of this Specification are suitable for all ordinary purposes, but certain additional precautions are necessary in special cases.

If a current transformer be employed having an unduly small current rating with respect to the whole generator capacity of the system in which it is installed, a short-circuit or fault current may cause its destruction before the automatic protective gear has operated. On the other hand, if the current rating of the transformer be unduly high with respect to the normal working current, the required accuracy of measurement may not be obtained.

For these reasons, when selecting current transformers for use in connection with large generating systems, it is important that the design and construction of any transformer should be carefully considered, both in relation to the normal currents to be measured and to the rated capacity of the generating plant with which the transformers are to be employed.

This subject is being studied by the Sub-Committee on Instruments with a view to including in a subsequent issue of this Specification suitable recommendations for the guidance of users.

APPENDIX II.

Use of Transformers with Electricity Meters.

When transformers are used with electricity meters, combined calibration of the meter and transformer is considered to be always necessary. Such calibration, however, should be specified separately.

II }

APPENDIX III.**Single Turn Current Transformers.**

Single turn current transformers cannot be expected to comply with the limits of Phase Error called for in Clause 22, when rated at :—

15 volt-amperes, and a primary current lower than 800 amperes.

40 volt-amperes, and a primary current lower than 1,200 amperes.

British Engineering Standards Association.

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